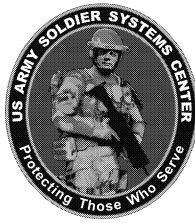


**TECHNICAL REPORT  
NATICK/TR-07/021**



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# **LAW ENFORCEMENT ADVANCED PROTECTION (LEAP) REQUIREMENTS FOCUS GROUP REPORT**

by  
**Adam DiChiara**  
and  
**Mary Addonizio**

September 2007

Final Report  
November 2006 – January 2007

**Approved for public release; distribution is unlimited**

**U.S. Army Natick Soldier Research, Development and Engineering Center  
Natick, Massachusetts 01760-5019**

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who participated in this focus group. Law Enforcement personnel should consider all aspects of personal protective equipment's performance in determination of its suitability for any required application.

## Table of Contents

List of Tables .....	iv
Preface.....	v
Section 1 - Introduction .....	1
• 1.1 Evaluation Objectives .....	1
• 1.2 User Focus Group Overview .....	1
• 1.3 Participants.....	2
• 1.4 Focus Group Methodology .....	3
• 1.5 Focus Group Strengths and Limitations .....	3
Section 2 - Focus Group Discussion Results .....	5
• 2.1 Personal Protective Equipment (PPE) Integration.....	5
• 2.2 Prioritizing Integration Issues – Survey Results.....	8
• 2.3 Chemical / Biological Protection.....	9
○ 2.3.1 Law Enforcement (LE) Specific Tasks.....	9
○ 2.3.2 Mission Role Task Matrix .....	10
○ 2.3.3 Law Enforcement Specific Tasks - Integration Issues.....	12
○ 2.3.4 Mission Role Duration.....	14
○ 2.3.5 Law Enforcement Specific Physical Activities Discussion .....	16
○ 2.3.6 Law Enforcement Specific Physical Activities – Integration Issues ..	17
○ 2.3.7 Ergonomic Testing Scenario Review.....	17
○ 2.3.8 Current CB PPE Discussion.....	23
• 2.4 Duty Uniform Discussion .....	24
○ 2.4.1 Current Duty Uniform Discussion .....	27
○ 2.4.2 Duty Uniform Protection Needs – Survey Results .....	28
• 2.5 Summarizing Discussion .....	28
Section 3 - Conclusions .....	29
Appendix A - Descriptions of Mission Roles .....	33
Appendix B - Ergonomic Scenario Descriptions.....	37
Appendix C – Integration Issues Survey Results.....	41
Appendix D – Duty Uniform Protective Needs Survey Results.....	45
Appendix E - Participant Information Survey Results .....	47

## **List of Tables**

Table 1. Participant Background Information .....	2
Table 2. Integration Issues Raised by the Participants .....	5
Table 3. Tasks Reviewed and Suggested by Participants .....	9
Table 4. Mission Role Task Matrix .....	11
Table 5. Expected Mission Role Durations .....	15
Table 6. Physical Activities Reviewed and Suggested by Participants .....	16
Table 7. Proposed Ergonomic Scenario for Perimeter Control .....	18
Table 8. Proposed Ergonomic Scenario for Tactical Operations.....	20
Table 9. Proposed Ergonomic Scenario for Criminal Investigation .....	22
Table 10. Duty Uniform Needs Suggested by Participants .....	25

## **Preface**

The U.S. Army Natick Soldier Research, Development and Engineering Center, (NSRDEC) in collaboration with the Department of Homeland Security, Office of Science and Technology, Office of Standards (DHS/S&T/Std), the National Institute of Standards and Technology – Office of Law Enforcement Standards (NIST/OLES), the National Institute of Justice, Office of Science and Technology (NIJ/OST), and the Center for Technology Commercialization (CTC), conducted a Law Enforcement Advanced Protection (LEAP) Requirements User Focus Group on November 15-16, 2006 in Arlington, Virginia. This report contains data reflecting comments and opinions of law enforcement professionals who participated in the focus group. This report was prepared under Project Number LEAP-CB-SAP. The period covered by this report was from November 2006 to January 2007.

This focus group supports the LEAP Program, and is one in a series of personal protective equipment (PPE) related user focus groups for members of the law enforcement community. Its purpose was primarily to collect data/criteria for operational requirements, PPE trends and concepts of operations (CONOPS) from representatives within the law enforcement community. Program participants represented a cross-section of the country's law enforcement community, covering different agencies, departments, and job functions. Focus group topics included: the current state of PPE for law enforcement; PPE integration and compatibility concerns; chemical/biological (CB) PPE and systems; CB response mission roles and mission-related tasks; and law enforcement duty uniforms standards related issues. Data collected through this focus group, coupled with on-going research and analysis, will be used in a number of LEAP-related activities, including the development of performance criteria for law enforcement specific PPE standards.





# **LAW ENFORCEMENT ADVANCED PROTECTION (LEAP) REQUIREMENTS FOCUS GROUP REPORT**

## **Section 1 - Introduction**

### **1.1 Evaluation Objectives**

Goals of this focus group were to:

- (1) validate data/criteria related to performance requirements for chemical-biological (CB) protective equipment,
- (2) discuss law enforcement CB mission roles,
- (3) refine CB ergonomic testing protocols,
- (4) identify existing problems/consideration affecting equipment integration, and
- (5) define criteria for the performance of the every day duty uniform worn by LE officers.

### **1.2 User Focus Group Overview**

*Subject:* User focus group for members of the law enforcement (LE) community, representing various agencies and regions to discuss their needs and opinions relating to:

- personal protective equipment (PPE)
- CB PPE and systems
- CB response roles
- duty uniforms

*Location and date:* Holiday Inn in Arlington, VA, November 15-16, 2006,

*Sponsor:* Department of Homeland Security, Office of Science and Technology, Office of Standards,

*Host Activity:* The U.S. Army Natick Soldier Research, Development and Engineering Center (NSRDEC), the National Institute of Standards and Technology – Office of Law Enforcement Standards (NIST-OLES)

*Facilitator:* The Center for Technology Commercialization (CTC), Westborough, MA. Chief Stephen Doherty, (Ret.)

### 1.3 Participants

Eleven members of the law enforcement community took part in the focus group. These members represented a cross section of the country's regional law enforcement community, various agencies, departments, chemical/biological expertise and job functions. Criteria for participation included: nation-wide distribution in parallel with geographic locations that represented potentially vulnerable areas; NIJ OST recommendations; past government-sponsored focus groups and/or focus groups analysis; other. Geographic locations were identified as having three or more large chemical plants or facilities within close proximity to each other. All participants had experience in various CB incident response and preparedness roles. Table 1 lists the participants' disciplines, years of experience and home states.

**Table 1. Participant Background Information**

<b>Responder Discipline</b>	<b>Years of Experience</b>	<b>Home State</b>
Chemical Biological Incident Response Force	1-5 years	MD
Crime Scene Entry Team, Forensic Services	More than 15 years	MA
Emergency Preparedness Unit Supervisor	More than 15 years	IN
Instructor	6-10 years	TX
Safety Manager / Industrial Hygienist	1-5 years	AZ
State Trooper	More than 15 years	NY
State Trooper, K9 Handler, Swat Operator	6-10 years	OH
Support Services	More than 15 years	MT
SWAT	More than 15 years	IL
SWAT Commander	More than 15 years	MI
WMD / HAZMAT Specialist	11-15 years	CA

Representatives from Department of Homeland Security – FEMA – Office of Preparedness, System Support Division (SSD)<sup>1</sup>, U.S. Army, Edgewood Chemical and Biological Center (ECBC), Department of Homeland Security, Office of Science and Technology, Office of Infrastructure and Geophysical Department, and the NIJ OST attended the focus groups as observers.

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<sup>1</sup> Formerly known as “Office of Grants and Training”

## **1.4 Focus Group Methodology**

The focus groups were structured. Each addressed a particular need or topic. In each discussion, participants were tasked with a specific objective, e.g., to produce a list of frequently performed physical activities, etc. As the focus group progressed, these objectives built upon outcomes of earlier discussions.

Participants answered a background questionnaire developed by NSRDEC that included questions related to their experience and use of CB equipment, duty uniforms and head protection. The questionnaire consisted of quantitative multiple choice, yes/no and rating scale questions. Data were analyzed using the Software Package for Social Sciences (SPSS), which tabulated summarized results and displayed means and frequencies of responses.

Participants also completed two smaller surveys tailored to specific discussion topics. One survey asked participants to prioritize in order, their top five integration concerns for PPE. Responses were open-ended, allowing participants to write about any integration issue that they felt was important. A similar survey was administered following the duty uniform focus group segment, asking participants to list the top five protective needs for a duty uniform.

Data from both of these surveys were analyzed by grouping the responses into categories based upon the equipment issue or problem area.

- Based upon their rankings, responses were given point values from one to five, with the highest ranked response receiving five points.
- A weighted sum score was computed for each category.

This overall weighted sum score totaled the combined weighted scores of all responses in a category and represented the frequency of response and relative ranking. The higher the weighted sum score, the greater the importance given to that category by participants.

## **1.5 Focus Group Strengths and Limitations**

Focus groups can be an effective tool to:

- collect attitudinal and experience based qualitative information,
- identify existing issues or potential problems with respect to products or policies, and
- help generate discussion for new ideas and solutions.

Another strength of focus groups is witnessing interactions and growth of opinions from participants with various stakes in a concept. Through these interactions, researchers hope to gain insights into user habits and preferences, which would otherwise be less accessible.

Focus groups can be limited in that they may not produce quantifiable and/or statistically significant data, and due to the small number of participants, results should not be generalized to a larger community. Also, it should be noted that ideas generated in focus groups are the views of individuals who may or may not always agree. Though in some cases, the group may reach a consensus; this should not be the expectation.

Discussion summaries in this report attempt to represent all views expressed, and note when differing opinions occur. Finally, due to the nature of focus groups, it can never be guaranteed that participants will express their viewpoints on all intended topics or stay to a planned agenda. Though the moderator tactfully guided the group and kept the discussion on course, participants were not discouraged from speaking their minds or raising outside issues they felt were relevant.

## Section 2 - Focus Group Discussion Results

### 2.1 Personal Protective Equipment (PPE) Integration

*Objective: Generate a detailed list of common equipment integration problems and ideas for potential solutions.*

Although this focus group dealt with PPE integration, participants discussed aspects of CB protection and duty uniform integration. An overarching theme, reiterated several times throughout the focus group, was the need for federal standards for law enforcement PPE. Table 2 lists integration issues raised by participants during the discussion, along with any suggestions mentioned for solving those problems.

**Table 2. Integration Issues Raised by the Participants**

Integration Issue	Problem Description
Ballistic / CB PPE Integration	Plate armor too bulky if worn under CB layer. Restricts access to items if worn over CB layer. Garments are noisy. Restrict range of motion. Headgear chin strap is difficult to use while wearing respirator.
Respirator Straps	Restrict access to equipment items.
Radio Access	Radio/communication gear is inaccessible when under CB layer, ballistic vest, or respirator straps. <i>Possible Solution: Provide easier access, or wireless solution.</i>
Bomb Suit / Mask interface	Bomb suit is only compatible with one brand of respirator mask.
Respirator Mask / Weapon Sight	Difficult to impossible to sight shoulder-fired weapon properly while wearing mask. Poor stock weld/site picture interface.
Vehicle Operation	Cannot sit in vehicle while wearing respirator equipment. Respirator tank must be removed.
Vehicle Storage	Need to keep in vehicle for quick access, but burden to check out multiple items each day. Want an all-in-one storage bag. Equipment degradation occurs in hot climates when stored in vehicles.

**Table 2. (Cont'd)**

Interagency / Interdepartmental	Incompatible equipment. Connectors, hose fittings, attachments not standard.
Detection Equipment	Not suited for tactical environment. Designed for fire departments. Vehicles lack detection equipment. <i>Possible Solution: Equip vehicles with detection capabilities.</i>
Duty Belt	Too much weight / bulk on hips. Lack of space for equipment. Leather materials absorb contaminants.
CB Breathability / Thermal Stress	Physical sustainability for officers wearing CB protective suits limited to as short as 20 minutes due to limited respiration. Affects safety, health, ability to perform. <i>Possible Solution: Want microclimate cooling or similar solution.</i>

The issue of equipment access was brought up several times, as seen in Table 2 above. Participants discussed many situations where their radio equipment is covered up by either their ballistic, CB or respiration equipment. In particular, some wanted a wireless push-to-talk radio that could be activated externally, allowing them to keep their main radio in any location while using some sort of hands-free or remote device. A few participants felt that there is definitely a need for this type of equipment and that the existing technology is inadequate.

Participants mentioned problems integrating their ballistic and CB protection, possibly as the result of sizing problems with their CB protective ensemble. Some said that it is not possible to wear their plate armor either under or over a CB layer. Others said that wearing some forms of ballistic protection under a CB layer is possible, but extremely restricting. In both cases, access to items is restricted when covered by these systems.

Participants raised integration considerations related to respiratory protective equipment. All of them described having trouble sighting their shoulder-fired weapons while wearing CB protective face pieces. Many felt that this impacts their ability to use a shoulder-fired weapon effectively. Additionally, some participants said that the most prominent brand of bomb suit is only compatible with one form of respirator mask. They felt that this incompatibility issue should be resolved by having an equipment standard.

In talking about vendor issues, some participants felt vendors and manufacturers claim they can meet equipment needs, though they may not completely understand those needs. Other participants stated that vendors do listen to users to understand user needs, but that the technology does not always work as designed. One example of how vendors listen to feedback from officers was when officers requested a color change for a piece of equipment from orange to black. The vendor complied and, as a result, the item's sales

increased significantly. Others thought it was unreasonable to expect vendors to meet officers' needs, unless there are formally recognized standards.

Some participants also discussed transportation related integration issues. Transportation of equipment is an issue, since there are multiple pieces of equipment for which officers are responsible. Having a single bag of items that officers could sign out from the department, instead of a variety of separate items, would help eliminate the burden. Some noted that storing equipment in their vehicle's trunk leads to premature equipment degradation because it can get extremely hot.

Many participants described the incompatibilities they have when they wear their CB PPE in vehicles. In particular, respirator equipment makes it impossible for officers to sit in a vehicle, which is a dilemma when they need to arrive at a scene already donned in their CB protective gear. Some said that officers take their respirator tanks off, while still in use, and place them on the seat next to them, which they noted is a violation of regulations, but is the only available option.

One participant raised the issue of equipment incompatibility from different departments or agencies. When multiple departments are involved in a CB incident, their equipment is often incompatible, which inhibits equipment interchangeability in necessary situations. This is particularly problematic with incompatible hose fittings, connections and adapters. Participants agreed that this is a serious problem and an unnecessary barrier in emergency situations, but could easily be resolved with a requirement to standardize all types of equipment connectors.

Several issues were identified concerning the leather duty belt for the duty uniform. Many participants have problems with equipment items sliding out of place on the belt, and stated that nylon belts work better. Participants felt that using a duty belt for the majority of their load carriage was an outdated approach considering the lack of space for the number of items they need to have accessible. Some felt that a load bearing vest would provide more real estate, better accessibility for devices and equipment, and would distribute weight better on the body.

Some participants also thought that their ability to detect and characterize CB threat parameters was inadequate, so they must rely on fire departments that do possess this ability. They felt that law enforcement should be similarly equipped to be able to determine this information on their own.

All participants agreed that thermal stress placed on officers wearing CB protective gear, and the related physical sustainability issues are serious problems adversely impacting officers' effectiveness, health and safety. Some stated that the operational duration in this equipment is as short as twenty minutes. They said that newer technology or some form of cooling is necessary.

## 2.2 Prioritizing Integration Issues – Survey Results

On a short survey following the group discussion, participants individually listed what they considered to be the top five PPE integration issues. Issues were ordered from one to five, with one being the most pressing issue, two being the second most pressing, and so on. Responses were tallied and categorized into several specific integration areas, shown in the table below. A weighted sum score, also in the table below, applies different weights to the five ranks to give an overall score representative of the participants' opinions. Also shown is the issue's frequency and average ranking out of those participants who listed it.

Integration Issue	Freq.	Avg Rank <sup>1</sup>	Weighted Sum <sup>2</sup>
Sustainability of Wearer	12	3.0	36
Communications Issues	8	2.5	28
Lack of a National Standard	7	3.0	22
Interagency / Interdepartmental Incompatibilities	4	2.2	15
Dexterity Issues	3	1.7	13
Difficulty of Donning / Doffing	4	3.3	11
Poor Visual Acuity	3	2.7	10
Durabilities Issues	3	3.3	8
Respirator Interchangability Issues (SCBA/PAPR)	2	2.5	7
Equipment Integration Problems in CB Ensemble	2	3.0	6
Inability to Characterize Threats / Validate Protection	2	3.0	6
Mobility Issues	3	4.3	5
Accessability of Equipment	1	2.0	4
Inadequate Equipment Testing	2	4.0	4
PPE Not Optimized for Regular Use	1	2.0	4
Difficulties with Decontamination	1	3.0	3
Equipment Weight	1	3.0	3
Weapons Sighting / Facemask Integration	2	4.5	3

<sup>1</sup> *Participants prioritized issues by ranking them 1 through 5. (1=Most pressing issue)*

<sup>2</sup> *Weighted sum determined by applying weight to each rank and computing the sum.*

*Weights: 1st=5pts, 2nd=4pts, 3rd=3pts, 4th=2pts, 5th=1pt.*

*Greater weighted sum indicates higher group ranking.*

Physical sustainability was the greatest integration concern. All participants listed aspects of heat stress or heat exhaustion at least once.

Communications was also a pressing issue; several participants described difficulties with integrating communications equipment into the CB ensemble, as well as radio problems, and hearing difficulties when using other equipment. Many participants described the lack of a national standard as an underlying cause of other issues. Dexterity, donning, doffing, and many other issues were described. A more detailed listing of these issues can be found in Appendix C.



## 2.3 Chemical / Biological Protection

This user focus group segment was conducted with a series of focus groups, each one having its own specific topic area and objectives. The goals were:

- to build a framework of criteria for CB protective equipment requirements by refining law enforcement roles and activities with respect to CB incident response, and
- to address related equipment needs, issues and standards.

### 2.3.1 Law Enforcement (LE) Specific Tasks

*Objective: Participants were shown a list of tasks specific to LE responders. They were asked whether the list of tasks was accurate and to provide any additional tasks that would be appropriate.*

**Table 3. Tasks Reviewed and Suggested by Participants**

Initial List of Tasks	Participant Added Tasks
Weapons Proficiency Weapon Retention Operate Equipment Traffic Direction Close Quarters Battle Crowd Control Fire and Movement Site Security Moving Targets Assistance to other Emergency Responders Weapons Transition CBRNE <sup>2</sup> Sampling, Monitoring CBRNE Evidence Collection Night / Low Light Engagement Self-Defense Vehicle Operations Suspect Control Decontamination	Communications (face to face) Radio Communications Rescue CB Perimeter Characterization Unassisted Equipment Donning

Participants agreed with all of the above tasks, but commented that CBRNE sampling and evidence collection should be two distinct tasks. They were originally presented as a combined task. Throughout the discussion, five tasks were added to the list (shown in the left column of the table above). Each one will be presented in more detail.

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<sup>2</sup> Chemical/Biological/Radiological/Nuclear Emergency

Several participants responded that communications is critical for LE responders and should be included on the task list. Face-to-face communication is often a problem when wearing a powered air purifying respirator (PAPR) or a self contained breathing apparatus (SCBA), particularly when communicating with the public about perimeter control issues. Radio communications can also be problematic.

Participants added rescue as a task, as it applies to hostage or suspect protection. They described the problem of being in a CB environment and finding a victim who needs first aid. In these cases, victims must be transferred to a non-contaminated environment where first aid can be administered. Participants also added that ambulatory and non-ambulatory rescues involve different activities. The rescue task is intended to address these types of situations.

Characterizing CB threat parameters is an important function that LE personnel need to perform. (Previously mentioned in the Integration section of this report.) Responders need to know where and when their CB protective gear needs to be donned and doffed, since wearing the equipment limits their effectiveness and physical sustainability. Participants felt that firefighters already possess threat characterization capability and this information can be shared through better communication.

Participants said that it is nearly impossible for law enforcement officers to don all of their CB PPE unassisted. They believed that officers have to be able to dress themselves in their protective gear if arriving alone to a contaminated area. To enable this, CB gear should be simple to put on. First responders also need access to this equipment in their vehicle. Since many officers do not typically have this equipment with them, participants felt that a policy needs to be in place to ensure that officers have this gear in their vehicles. At the same time, having to sign out several items each day would be burdensome to officers; it would be advantageous if all necessary equipment could be kept in a single bag (as mentioned in the Integration section of this report). At a minimum, every officer needs to have respiratory protection available at all times.

### **2.3.2 Mission Role Task Matrix**

*Objective: Generate a matrix associating each defined LE specific task to relevant LE mission roles.*

Participants were asked to identify all LE specific tasks applicable to each mission role. Mission roles are described in Appendix A. Table 4 shows which tasks are identified for each role, based on a group consensus.

**Table 4. Mission Role Task Matrix**

Tasks	Mission Roles				
	First Responder	Perimeter Control	Tactical Operations	Criminal Investigation	HAZMAT
Weapons Proficiency	•	•	•		
Operate Equipment	•	•	•	•	•
Close Quarters Battle - tactical situation	•	•	•		
Ground Fighting - hand to hand	•	•	•		
Fire & Movement	•	•	•		
Engage Moving Targets	•	•	•		
Weapons Transition	•	•	•		
Night / Low Light Engagement	•	•	•		
Self-Defense	•	•	•		
Suspect/Victim Control	•	•	•		
Weapon Retention	•	•	•		
Traffic Direction/ Crowd Control	•	•			
Evacuation	•	•	•		
Site Security	•	•	•	•	•
Assistance of Other Responders	•	•	•	•	•
CBRNE Sampling, Monitoring		•		•	•
CBRNE Evidence Collection			•	•	•
Vehicle Operations	•	•	•	•	•
Decontamination (victims, public, LE personnel)					•
Decontamination (equipment, weapons, vehicle)					•

### 2.3.3 Law Enforcement Specific Tasks - Integration Issues

*Objective: Identify possible integration issues related to each of the LE specific tasks previously defined.*

For each LE specific task, participants were asked to describe any integration issues that typically occur relating to that task. In some cases, participants grouped together tasks that shared the same types of integration issues.

LE Specific Tasks	Related Integration Issues
Weapons Proficiency Weapon Retention Operating Equipment Close Quarters Battle Ground Fighting Fire & Movement Moving Targets Weapons Transition Night / Low-Light Engagement Self-Defense Suspect Detaining	Dexterity / Tactility Weapon Aiming / Sighting Weapon Access Weapon Clearing / Reloading Durability Physical Sustainability Ability to Communicate Visual Acuity Auditory Acuity Unassisted Equipment Donning

The main integration issues affecting weapon effectiveness in a CB ensemble were:

- dexterity,
- the ability to sight a shoulder-fired weapon, and
- having quick access to their weapon.

Wearing gloves makes it difficult to operate their weapon due to bulk, restricted movement, and decreased tactility/sensitivity. Achieving a good sight picture while aiming a shoulder-fired weapon is difficult because of: the standoff created from the CB mask; decreased peripheral vision; perspiring and restricted arm movement. Participants felt that increased training is critical in performing the above weapons tasks while wearing CB gear.

Participants were asked to consider the terms “Close Quarters Battle” and “Ground Fighting” to decide if these were commonly used and accurate. There was consensus that both terms are typically used, with “Close Quarters Battle” involving weapons and “Ground Fighting” referring to hand-to-hand combat.

The lack of real estate on the duty belt hindered weapons' retention. Participants felt that too much load is placed on their waist, adversely affecting weapon retention, and increasing susceptibility to lower lumbar injury.

LE Specific Tasks		Related Integration Issues
Traffic Direction	}	Communication Mobility Self-Identification

The ability to communicate effectively was the primary concern. Participants also felt that an officer's ability to identify themselves to the public as LE was crucial and depended upon the ability to communicate effectively while wearing CB protective equipment.

Several integration considerations were raised related to traffic direction. In addition, time required for evacuation and crowd control goes well beyond the length of time someone can physically operate in a CB system, and requires continuously rotating officers in and out of these positions.

Some participants felt that traffic direction should take place far from a CB zone; in which case, officers would not necessarily be wearing CB protective equipment. Others disagreed that this task would always take place outside of a contaminated area and stated that CB protective equipment would, therefore be worn.

LE Specific Tasks		Related Integration Issues
Site Security	}	Physical Sustainability Monitoring of Individuals

Some participants mentioned that there are often inner and outer perimeters that need to be controlled, and each requires a different type of security. They also added that site security is an element of each mission role, though it may mean something different for each case. Physical sustainability for officers wearing CB PPE becomes a problem for site security. If a perimeter is large, many officers are required to enforce the area. This makes it hard to rotate personnel shifts because most available officers would already be involved. Participants stressed that the amount of time officers can effectively perform while wearing a CB ensemble can be as low as twenty minutes due to physical sustainability limitations. They also added that wearing a CB ensemble makes monitoring of individuals difficult.

LE Specific Tasks		Related Integration Issues
Assistance to Other Responders	}	Equipment Compatibility

The primary issue regarding assistance to other responders is the use of incompatible equipment among different LE departments and agencies. (See page 8.)

LE Specific Tasks		Related Integration Issues
Evacuation of Victims Decontamination of LE Personnel Decontamination of Equipment	}	Limited Capability

Most participants stated that LE performs decontamination for its own personnel, while fire departments handle decontamination for the public. They felt that LE has a limited capability in this area and fire departments are better suited to perform this task. LE personnel typically only conduct decontamination efforts when fire department services are unavailable or are overwhelmed by decontamination needs.

Participants felt that decontamination of weapons and equipment is a significant problem. Many said that they replace contaminated equipment because they lack the capability to decontaminate it effectively. Some added that their departments carry surpluses of weapons and equipment, to replace those that get contaminated.

### 2.3.4 Mission Role Duration

*Objective: Estimate a possible range for the expected length of time a LE officer would need to be protected from a CB threat during each of the mission roles.*

Focus group participants were asked to consider how long officers might be required to wear their CB ensemble during each of the five mission roles. They were told that these times should represent how long their CB protective gear would need to remain effective. Responses varied dramatically based on each participant's interpretation of a mission role type. A consensus was reached, assuming that officers, particularly first responders typically perform multiple mission roles as needs dictate. It was also mentioned that the CB protective equipment used by officers for each profile may be standardized across their department, so it needs to accommodate the longest time required by any wearer.

Participants felt that it was important to be conservative when estimating duration time. They based this on the fact that CB protective capabilities are agent dependant, and also affected by temperature, humidity and CB concentration levels. Some said that they

typically assume that CB protective equipment will only be effective for half as long as is specified, to be safe.

**Table 5. Expected Mission Role Durations**

<b>Mission Role</b>	<b>Duration for CB Protection</b>
First Responder/Reporter Perimeter Control	8 - 12 hours
Tactical Operations	4 - 6 hours
Criminal Investigation	8 - 12 hours
HAZMAT	Could not answer

Several participants initially felt that first responder duties should require no more than 60 minutes, based on “recognizing,” “identifying,” “isolating” the situation and “notifying” command. However, through further discussion they agreed that after the first responder conducts these initial duties, that officer will naturally fall back into a perimeter control role as long as they are not injured or contaminated. Once a first responder arrives they are likely to be on the scene for the duration of their shift, if not longer. The group consensus then became that the duration of these roles should at least be an 8-12 hour shift.

Some commented that it is important that first responder/reporter have the capability to quickly and accurately characterize the threat level. The group all agreed that first responders/reporters go into situations without knowing the dangers, because that is their job. They felt that simple forms of monitoring gear like having CB monitoring capabilities in vehicles, as well as training could help protect officers and provide earlier information about the nature of threats.

All in the group agreed that 4-6 hours is a realistic timeframe for tactical operations. They said that officers in this role get in and out as fast as possible. They mentioned also that heat stress factors are more critical in this role.

For criminal investigation, participants also felt that an 8-12 hour shift was a realistic timeframe, although they felt that a wearer could not be sustained in the current gear for that duration. They thought that it would be necessary to rotate personnel shifts in this role, but that there are not enough people trained to do the job. In reality, the same people would conduct these duties for the duration.

In terms of the HAZMAT mission role, several participants said fire departments handle those duties, and that they believed there is a NFPA standard guiding them. When asked if they felt that LE should adopt the NFPA standard, participants felt that LE needs its own standard, though they would be willing to adopt the NFPA standard if there was a thorough review of it.

### 2.3.5 Law Enforcement Specific Physical Activities Discussion

*Objective: Review a proposed list of physical activities, relevant to the LE mission roles and offer changes or additions.*

Participants were shown a list of physical activities that responders needed to perform to complete the tasks outlined previously and were asked to validate the list's accuracy by adding, removing or changing any activities based on what they felt was important.

Participants agreed that someone could be expected to do all of the listed activities while wearing CB protective gear. Participants added the activities shown in the right column of Table 6.

**Table 6. Physical Activities Reviewed and Suggested by Participants**

Original List of Physical Activities	Participant Added Activities
Running	Pushing
Crawling	Pulling
Kneeling	Writing
Twisting	Talking, Responding
Jumping	Sitting
Climbing	Walking
Standing Extended Periods	Drinking / Rehydrating
Lifting	Sighting a Weapon
Laying Prone	Facial Gesturing (for communicating)
Manual Dexterity	Using Keypad / Laptop
Hearing Acuity	
Visual Acuity	

Participants stated that pushing and pulling are tasks criminal investigators typically perform.

Sitting in or driving a vehicle while wearing CB respiration gear posed a significant integration issue. (See page 9.)

Participants stressed drinking or rehydrating is an important need or aspect of physical sustainability, which is currently difficult or impossible to do while wearing CB protective equipment.



### 2.3.6 Law Enforcement Specific Physical Activities – Integration Issues

*Objective: Identify possible integration issues related to each LE specific physical activity previously defined.*

Based on their responses regarding physical activities, participants were asked to describe any types of equipment incompatibilities they experience when performing these actions.

Physical Activities	Equipment Conflict
Writing Using Keypad / Laptop	Dexterity Issues
Talking, Responding Visual Acuity Sighting a Weapon Facial Gesturing (for communicating)	Seal of mask can be affected
Running	Loose Equipment Items Falling Off

In addition to the above, it was also asked whether improper sizing of CB garments results in mobility issues for wearers. Several participants stated that their department has custom sized CB garments for each individual. Several said that they would like their regular duty boots to be CB protective, claiming that there is a boot product available which meets military guidelines, but is not authorized for use by law enforcement.

### 2.3.7 Ergonomic Testing Scenario Review

*Objective: Review proposed scenarios for ergonomic testing, specific to three mission roles, and offer changes or additions. Perimeter Control, Tactical Operations and Criminal Investigation scenarios were reviewed.*

Proposed ergonomic testing scenarios were presented for the perimeter control, tactical operations and criminal investigation roles. These scenarios incorporate standardized ergonomic testing methods into real world situations that represent LE's response to a CB incident. Participants were asked if these scenarios accurately represented the types of activities officers would perform in each situation, and whether they felt that the scenarios would fully test the scope of actions that officers might be expected to perform.

In all cases, participants felt all ergonomic scenarios must include the full scope of an officer's involvement in that mission role, beginning as soon as they arrive on the scene with donning equipment, and ending with decontamination and doffing equipment. They also stressed the importance of testing the ability to communicate effectively with others,

in person and over the radio. This requires the ability for all parties who are communicating to hear and to be understood. They also commented that any terminology used in these scenarios should be the same terms used by civilian law enforcement as opposed to military terms.

### **Perimeter Control**

Table 7 outlines steps in the ergonomic assessment plan for the perimeter control mission role. Comments and additional steps recommended by the participants are listed in the right column.

**Table 7. Proposed Ergonomic Scenario for Perimeter Control**

Step	Original Scenario Task	Participant Additions / Comments
		Don CB gear unassisted.
		Get in vehicle and drive farther away from incident scene. (Placement of this step TBD)
1	From starting mark, run 50 ft to area to be controlled.	
2	Secure caution tape around one item (doorknob, stake, etc) and roll out at least 10 ft of tape before securing the other end. Tape should be approx 4 ft off the ground.	
3	Run back 50 feet to starting mark.	
4	Use radio to call command post. Write down instructions received via radio from command post.	2 way communication over radio.
5	Retrieve notebook and pen. Draw rough sketch/map of scene.	
6	Walk back to caution tape, stepping over a guardrail on the way.	
7	Duck under caution tape and walk 20 ft beyond tape to 'victim' (dummy). Grab dummy under the arms and remove from cordoned-off area.	Change dummy to a real person. Ensure two-way verbal communication with victim is possible.
8	Once in safe area, render first aid to victim by wrapping upper arm with bandage.	
9	Stand up and repair any damage to caution tape caused from dragging dummy to safe area outside perimeter.	
10	Walk back (50 ft) to starting area.	
11	Take out flashlight, turn it on, and pan across area beyond caution tape. Stow flashlight.	

**Table 7. (Cont'd)**

12	Draw weapon from holster, hold upward “at attention” with two hands for 10 seconds, then re-holster weapon securely.	Remove words “at attention”
13	Run approximately 10 ft to other end of caution tape.	
14	Re-draw weapon, aim, speak appropriate commands, and simulate firing two shots. Remove magazine from weapon, stow it, remove new magazine from belt and insert new magazine into weapon. Re-holster weapon.	
		Decon of officer and equipment.
		Doff gear

Participants felt that upon arrival, the perimeter control officer would need to don their CB protective suit and respiratory protection. Many commented that this is a very difficult or impossible task for someone to do unassisted with current gear, but that it is a necessary capability for someone in this mission role. For this reason, several participants felt that a duty uniform with CB protective properties would allow officers some level of CB protection at all times. Some added that officers are able to don a Level B protective garment without assistance, but not any higher levels.

Several participants noted that an officer doing perimeter control might be required to retreat from an initial perimeter and set up a new perimeter farther away from the incident scene. In a realistic event, an officer may need to return to their vehicle and drive a certain distance away before proceeding. This task would require accessing keys and operating a vehicle successfully.

For this scenario, participants felt that the dummy victim should be replaced with a real person to simulate actual communications. This would require two-way, face-to-face communication tasks such as asking the victim for information, responding to this information and giving the victim instructions. The victim must also demonstrate they heard and understood the communications from the officer. Participants also added a radio communication task with incident command requiring a similar form of two-way verbal interaction.

### **Tactical Operations**

Participants felt this scenario needs to be performed by a team unit. In some cases, officers would have different tasks to perform to assist each other or complete objectives.

**Table 8. Proposed Ergonomic Scenario for Tactical Operations**

Step	Original Scenario Task	Participant Additions / Comments
		Don CB gear with assistance
		Scenario should include a team of 4-8 people
1.	Walk sideways along wall for 20 feet, stopping at closed door that opens in (away from approaching individuals).	Climb 6 foot wall, fence, or ladder
2.	a. Open door from position aside door (using door handle/knob). (or) b. Force open door with ram carried to door by subject.	Change to “fortified door”. Use explosive breach and ram. Make team activity (separate tasks) Covert communication between officers.
3.	Toss a “flash bang” grenade into doorway from position aside door.	
4.	Wait 10 seconds, then enter doorway with weapon drawn and ready, dropping immediately to a squatting position. Mock aim and fire the weapon.	Remove: “wait 10 seconds”. Enter immediately after detonation. Squatting is typically not done during tactical activities. Use shoulder weapon, transition to a holstered secondary weapon, re-holster and reload primary weapon.
5.	Enter area beyond doorway.	
		Add: multiple room clearings
		Go downstairs into dark/low light basement (possibly incorporate night vision devices)
		Have two-way communication between team members, both verbal and radio.
6.	Speak appropriate verbal commands to dummy lying on floor 10 feet inside door, while keeping weapon trained on dummy.	Use real person instead of dummy. Add 2-way communication between officer and suspect.
7.	Approach dummy.	
8.	Kneel next to dummy. Holster weapon. Use handcuffs to restrain the dummy’s arms behind its back.	Replace: “handcuffs” with “flex cuffs”
9.	Drag dummy out the door by grasping it under the arms.	
		Use “grab handle” on back of suit to drag a downed officer.
		Decon of officers and equipment.
		Doff gear

As with perimeter control, participants felt that the tactical operations scenario should start with donning a CB protective ensemble.

In this case, participants said that tactical operations will always be a multiple person activity, requiring about 4-8 people.

In steps related to breaching the door for entry, participants recommended modifications to include a fortified door where the team of officers would use an explosive breach or a ram to gain entry into the building. The explosive breach task would require fine motor skills and cooperation, where officers can perform different tasks to communicate covertly with and help each other. The assessment should evaluate the officers' ability to understand covert communications and signaling.

The group recommended that the officers should be required to switch between their shoulder weapon and their holstered weapon, shown in Task 4 above. This would not only evaluate accessibility of these weapons, but also identify any integration issues from other straps and equipment.

Participants felt that the officers should move through multiple rooms and floors within the building, including entry into a dark or low-light basement to find a potential suspect. The team should use radio communications throughout the exercise and demonstrate a clear understanding of all transmissions. As with the perimeter control assessment, the suspect should be a real person with whom the officers can have some kind of two-way verbal communication.

Additional suggestions were provided regarding the prescribed equipment. Participants recommended using flex cuffs, as opposed to hand cuffs. Some felt that officers should use hearing protection, to assess any communication difficulties or integration issues of using this equipment. As bright displays on electronic equipment can become a target in low light tactical situations, the test should use equipment with dim light displays. There were also suggestions from participants to use night vision devices in the dark section of the building.

### **Criminal Investigation**

Participants thought that this scenario (Table 9) would need to be performed by a team of officers. They recommended adding several tasks where the officers would assist each other to complete objectives.

**Table 9. Proposed Ergonomic Scenario for Criminal Investigation**

Step	Original Scenario Task	Participant Additions / Comments
		Don CB gear with assistance.
		Enter in teams of two.
1	Walk 25 ft to crime scene. On the way, subject will step over/around several “X” marks on the floor placed 2 ft apart and on different sides of the pathway. In addition, a narrow hallway will be used as part or all of the 25 ft available; If not available a pathway will be marked on the floor and the subject must walk within the lines.	Push/pull wheeled box of equipment around obstacles and through pathway.
2	Approach a table with a 2-inch square marked off at the far side of the table.	
		Use a camera to record video of the crime scene. Place a measuring device next to evidence for relative size in video recording.
		Use proper handling techniques throughout scenario. Requires wearing multiple layers of gloves, and removing properly to prevent cross-contamination. (10-15 pairs of gloves)
3	Bend forward as needed to use fingerprint kit to powder, dust and tape the print, and then remove the tape and secure the print on the tape.	Photograph fingerprint prior to placing in bag.
		Add 2-way radio communication to command: What is being picked up and how is it being labeled.
4	Move 4 ft to the side, and locate small item (e.g., pin from O’Conner test) on floor. Squat and pick up item with tweezers. Place item in paper bag. Secure paper bag.	One officer labels evidence bag and holds open. Second officer picks up item and places in bag. Incorporate 2-way verbal communication between officers.
5	Stand up, move 6 ft further to same side. Squat down, retrieve digital camera and take photo of “object” on floor.	
		Use atmospheric monitoring equipment to monitor and sample CB agents.
6	Stand, secure all items collected or used as necessary, move 6 ft backwards, then turn around and walk back to starting point.	
		Decontaminate officers and equipment.
		Doff gear

As with the previous scenarios, participants believed there should be a step to assess donning and doffing CB gear.

Participants added pushing or pulling a wheeled box containing a crime scene kit from the staging area to the crime scene. They felt this is a typical task in this scenario, and will help to assess mobility.

Video and photographic recording of the evidence and crime scene were tasks that the group thought would require fine motor skills and manual dexterity. Video recording should be performed initially to document the scene, and detailed photographs should record evidence processing. During the detailed evidence collection, one officer will operate the digital camera, while a second officer will place a measurement reference next to the pieces of evidence. This would provide a clear reference point for the evidence collected.

Participants stressed the importance of proper handling procedures for criminal investigators. They said that at least 15 layers of latex gloves can be worn by investigators, to allow for removal of gloves to prevent cross contamination. In this scenario, one officer is considered “clean” and one is considered “dirty.” The clean officer operates the video equipment and labels bags, while the dirty officer physically collects evidence.

Again, assessing communication was emphasized for this assessment plan. Suggestions were made for both radio and verbal two-way interactions between officers and command. In this case, one officer will radio command before processing an item. They will identify the evidentiary object and label its description on the evidence collection bag.

Participants also added a task to monitor for CB agents while in the contaminated area by performing sampling for evidentiary purposes. This task would demand fine motor skills and dexterity.

### **2.3.8 Current CB PPE Discussion**

*Objective: For each participant to describe their current CB equipment and discuss what, in their opinion, are its positive and negative features.*

This was a round-robin discussion. Each participant was asked to describe what they currently use for CB PPE and to tell the group what they feel are the positive and negative aspects associated with the system. Most participants reported having multiple CB garments, and the ones being referred to were not always specifically identified.

Several participants mentioned Tychem™ garments. Positive comments were that they are inexpensive, easy to don and provide relatively good functionality for the cost.

Complaints about the suits were that they are noisy to wear, sometimes uncomfortable and designed primarily for the chemical industry.

Tyvek™ garments were also discussed by many participants. Some liked the material, adding that it is thin and meets their needs. One negative issue raised by a participant was that the garment's hood can restrain movement.

Participants also discussed Saratoga™ suits. There were many positive comments about the garment, including good mobility and a general liking. Some negative comments were that it can be hard to don, and is somewhat thick. One participant mentioned that it protects against vapor threats but not liquid threats.

A few participants mentioned using Nomex™ CB suits. They felt that these suits were inappropriate for law enforcement, adding that they provide flash protection, which is not needed by LE and adds excess weight and stiffness.

In general, participants mentioned several times that their garments were not designed to meet LE's needs, and as a result, either lack necessary capabilities or provide capabilities that are not needed. Heat stress was mentioned by all participants as a significant negative aspect that results from wearing any of the CB garments mentioned. They felt that heat stress dramatically affects the wearer's physical sustainability, safety, and effectiveness.

## **2.4 Duty Uniform Discussion**

*Objective: Discuss if there is a need for a federal duty uniform standard, and identify a list of needs for a new duty uniform.*

Participants discussed: whether a federal standard for duty uniforms is needed; various protective and functional needs for duty uniforms, and problems they experience with their current uniforms.

Participants were asked to brainstorm a list of needs/capabilities for a new duty uniform, including aspects of protection, wearability, appearance, and any other properties they felt were important. Table 10 summarizes the needs identified by participants.



**Table 10. Duty Uniform Needs Suggested by Participants**

<b>Duty Uniform Needs</b>
Moderate level of integrated CB protection Protection from blood borne pathogens / body fluids Some level of ballistic protection Puncture/Stab protection Flame protection (non-melting) Sun/UV protection Ability to decontaminate uniform Measurable lifecycle / Measurable Protection Effectiveness Durable Lightweight Breathable Comfortable for daily wear Launderability / Stain Resistance Professional “Law Enforcement” appearance Specific protection standards Reflectivity

Most participants felt that the duty uniform should incorporate a minimum amount of CB protection for instances when officers respond to an incident with an unknown CB threat. They were concerned particularly about physical contact with CB substances and blood borne pathogens in the form of body fluids, which could be absorbed into their uniform material.

Ballistic protection was also discussed. Participants stressed that it should not compromise the comfort, wearability or breathability of the uniform. Several participants commented that they have experienced problems with protective equipment affecting the wearer’s comfort in the uniform. They also mentioned puncture resistance, with one participant describing a currently available puncture resistant fabric that is very thin.

The issue of uniform appearance was also raised by several participants who felt that departments may be resistant to change due to traditions and the need to present a unique identity. One participant commented that their department’s uniform committee places such a high importance on appearance that they never address uniform functionality. Many participants felt that appearance of the uniform is significant due to cultural and generational differences between younger and older officers. Older officers are described as preferring consistency and a display of authority, while younger officers place more importance on performance and functionality. Participants acknowledged that the culture is shifting towards the newer philosophy over time as a result of active younger officers on uniform boards and successful uniform wear testing.

Participants agreed that performance and functionality should be the focus; however appearance cannot be ignored. If new styles are adopted, it is important that they

maintain an image unique to law enforcement. Several participants felt that it is important for officers to “look like a cop, not a security guard.” Some discussed the belief that a sloppier looking officer is more likely to be engaged violently than a “squared away” looking officer, due possibly to psychological effects. Participants agreed that whether this effect is real or not, it is important for officers to have a good appearance. Another aspect important to both functionality and appearance that participants raised is for the uniform to be easy to care for and stain resistant.

For several participants, individual officers in their departments purchase their own uniforms using a clothing allowance. They are allowed to choose from a set of approved uniform items, and may opt for more or less expensive versions. Some felt that most officers “just want stuff that looks cool,” and will base which uniform items they purchase on that. Other participants said that their departments make all uniform purchases and provide money to officers for cleaning.

In discussing the concept of CB protection, several participants were concerned about how effective the protection would be after time and multiple launderings. Some participants felt that this would shorten the lifecycle of the uniforms, increasing the replacement rate and affecting uniform funding aspects. Additionally, the individual officer needs to be able to measure if the CB protection of the garment is maintained, as opposed to a third party in their department. A few participants then raised the concept of placing time limits on the life spans of duty uniforms. This would be established by a uniform standard and would let departments know how long uniforms were expected to maintain CB protection levels. Some participants felt that this would mean higher costs for officers. Other participants believed that if a federal standard for uniform life cycles existed, then departments would be able to budget for replacements up front. This would require additional funding, but these participants believed that a standard should help establish additional federal funding for this purpose.

Participants were asked if a duty uniform should have some kind of knee or elbow padding. Some preferred modular pads. Others thought that the uniform should have some kind of functional reinforcement in those areas, but not as thick as typical pads.

Reflectivity concerns were also discussed. Participants mentioned instances when officers need to be easily seen, such as a dark highway and instances when they need to be concealed. One participant proposed built-in reflector straps that can be rolled up or down.

Some integration issues specific to the duty uniform were discussed. As a whole, participants complained about the current duty belt system putting too much weight on the waist, and the need for an ergonomic design. (See pages 8 and 14.) A few participants also mentioned that they would like a Velcro system for carrying items that would allow for easier access.

Another significant issue raised by participants dealt with radio communications. Feeling that the radio is too bulky and heavy for the belt, they felt there needs to be better

technology to produce a radio that's easier to carry as well as use. Some commented that radio size is dictated by battery size, which must conform to standards for radio duration. A few participants said they would like a hands free feature for their radios, which would allow them to use something such as a wireless earpiece.

There were also suggestions to incorporate GPS into a radio, or otherwise provide the capability for locating an officer's position. They felt that this is an important capability to have in situations where officers are injured and unconscious. One participant mentioned that his department has vehicle locators in all their vehicles. Adoption of this technology was initially met with resistance from the union, in some part out of fear of complications regarding privacy issues and internal affairs investigations. However, eventually the technology was accepted as it was shown to not only help departments operate, but also to verify officers' claims and produce a more efficient internal affairs process.

#### **2.4.1 Current Duty Uniform Discussion**

*Objective: For each participant to individually describe their current duty uniform and discuss what, in their opinion, are the positive and negative features of it.*

Similar to the discussion of current CB PPE, this discussion was conducted as a round-robin where each of the participants individually described what they currently wear for their duty uniform. They were asked to describe their likes, dislikes, and areas for improvement. In many cases the types of uniforms being referred to were not specifically identified.

Some of their positive comments reflected generally good functionality of the uniforms and a lack of any major problems. One stated that they value functionality over all else, adding that "it does the job." This was also evident in comments about the durability and ability to easily care for the uniforms. Some said that the amount of wear and tear was acceptable and not a significant issue that warranted concern. Appearance was also mentioned a few times as a positive aspect.

A few participants, however, felt that that their uniforms addressed appearance over functionality. One participant said that the winter uniform in their department is steeped in tradition and looks great, but is not practical. A few others mentioned comfort issues in certain circumstances, such as rain or hot weather. Also, some participants complained about having "dry clean only" uniforms and the associated costs for officers.

## 2.4.2 Duty Uniform Protection Needs – Survey Results

Participants were given another short survey, to list what they considered to be the top five protection needs for a duty uniform. As with the integration survey, the participants were asked to order their issues from one to five, with one being the greatest protection need, two being the second greatest need, and so on. These responses were tallied into several specific protection categories, shown in the following table. A weighted sum score is shown in the table below which applies different weights to the five ranks to give an overall score representative of the participants' opinions. Also shown is the frequency and average ranking for each protection need. This survey was completed by ten of the total eleven participants.

Protection Need	Freq.	Avg Rank <sup>1</sup>	Weighted Sum <sup>2</sup>
Ballistic Protection	6	1.5	27
CB Protection	10	3.4	26
Blood, Fluid, Pathogens	5	2.2	19
Durability	6	3.0	18
Cut/Puncture Protection	3	1.7	13
Functionality	3	1.7	13
Comfort / Fit	4	4.0	8
Environmental Protection	3	3.3	8
Thermal Comfort	4	4.0	8
Appearance	4	4.3	7
Flame / Flash protection	2	2.5	7
Personal Location	1	4.0	2

<sup>1</sup> *Participants prioritized needs by ranking them 1 through 5. (1 = Greatest Need)*

<sup>2</sup> *Weighted sum determined by applying weight to each rank and computing the sum.*

*Weights: 1st=5pts, 2nd=4pts, 3rd=3pts, 4th=2pts, 5th=1pt.*

*Greater weighted sum indicates higher group ranking.*

Overall, ballistic protection and CB protection were identified as the greatest protection needs for any new duty uniform. Ballistic protection received the highest average ranking by just over half of the group, while CB protection was listed by all of participants. Also, protection against blood borne pathogens was shown to be highly important for half of the participants. Other specific protective needs, as well as other uniform features such as comfort, appearance, durability, and functionality were also included. A more detailed summary of these protective needs can be found in Appendix D.

## 2.5 Summarizing Discussion

Participants ended the focus group discussion by emphasizing the need for a federal set of standards for law enforcement equipment. All participants felt that this is an absolute necessity.

They wanted to make clear that the standards not only need to be established, but enforced, with proper support throughout the law enforcement system. This scope included an overarching body to create and continually review the standards, as well as ensure they are met with compliance in departmental processes, agency interoperability, and manufacturer compliance in product standards and testing.

More specifically, participants felt that different sets of standards may need to be established for different needs. With respect to the duty uniform, participants thought that one overall standard would *not* work for all officers who wear a duty uniform. For instance, standards for an administrative officer's or bike officer's duty uniform may need to be different from those of everyday patrol officer's.

Finally, several participants expressed gratitude for the opportunity to share their opinions and discuss issues important to them. Many said that they learned a good deal from speaking with their participant colleagues from around the country, and were looking forward to sharing this information with others in their departments when they returned home.

### **Section 3 - Conclusions**

More than half of the participants had 15 or more years of law enforcement experience. Job duties varied between office work, day-to-day operations, or tactical and specialized functions. Also, some participants said they respond to CB incidents often, while for others it was much less frequent. (Several survey questions addressed the individuals' experience, job duties, PPE usage, and duty uniform wear. A complete summary of the participant information survey results can be found in Appendix E.)

An overarching theme emerged from this LEAP User focus group, relevant to all topic areas: the participants were concerned about the lack of a national set of standards for equipment requirements specific to the law enforcement community. In both the survey and the discussions, they felt that the standards created for the fire community do not adequately address the unique needs of law enforcement first responder/reporter, perimeter control, tactical operations, criminal investigations, and HAZMAT operations. Participants cited examples and reasons of how the lack of a national set of standards limits their effectiveness and causes inefficiencies in their operations. Participants also felt that the organization or body that creates any national set of standards would need to work cooperatively with various stakeholder organizations in establishing the standards to ensure that they are met.

### **3.1 PPE Integration**

During the PPE integration discussion, participants described several typical integration problems they experience with their equipment. Most integration issues discussed involved restricted equipment access due to obstruction or concealment by other gear. Radio access is particularly problematic. Participants also said that there are problems wearing plate armor with a CB ensemble due to bulk and restrictiveness. Further, when participants wear respirator masks, they have trouble sighting a shoulder fired weapon. Also, interagency equipment incompatibilities exist, which participants believe could be resolved by standardization.

Physical sustainability of officers in CB ensembles ranked highest throughout the focus group discussions and on the short survey for PPE Integration. Communications issues ranked second highest, and the lack of a national standard for law enforcement protective equipment ranked third. Difficulties with dexterity, donning, doffing, visual acuity, and accessibility were also identified, echoing comments made throughout the focus group discussions.

### **3.2 Chemical/Biological Protection**

In the CB protection discussion, the participants discussed the proposed mission roles, relevant activities for law enforcement, and related integration issues. They felt that physical sustainability of equipment wearers, communication, mobility, donning/doffing and weapons integration issues greatly impacted their ability to perform effectively and for extended periods of time in a CB environment. In particular, heat stress and respiratory sustainability while wearing CB protective equipment were brought up several times as safety issues and a major limiting factors in officers' abilities to perform their duties.

Participants also debated the exact nature of the roles officers would have during a CB incident. They lacked agreement regarding the distinction between first responder/reporter and perimeter control mission roles in both the discussions and the surveys. Most participants felt that perimeter control and criminal investigation would last approximately one shift and tactical duties require slightly less time. They also disagreed regarding the role of law enforcement in HAZMAT operations; some participants felt this was the responsibility of fire services.

Participants were presented with potential scenarios for evaluating human factor issues resulting from wearing CB protective equipment in the three mission roles. They were asked whether the steps described accurately represented the scope of tasks officers would perform in each scenario, and to add any additional steps they felt would add to testing or remove any which were not appropriate. In all three scenarios, participants added steps to incorporate donning and doffing equipment. They also added steps to test the ability to communicate effectively verbally, over radio, and through gestures.

Participants rated the average durability rating of their CB ensembles as “Slightly Good,” with tearing and abrasion identified as the most common issues they experience. See Appendix E, question 19, for more information related to protective garments currently used by the participants.

### **3.3 Duty Uniform**

In addition to standards for equipment, participants also wanted a federal duty uniform standard and they described several features that a new uniform should incorporate. For example, participants wanted some minimal level of protection against chemical, biological, and blood borne pathogen threats, to protect officers who must respond to incidents without knowledge of these dangers or any form of protection against them. Comfort and functionality were also critical issues. They stated that officers and departments are deeply concerned with uniform appearance.

They mentioned several factors that are important to the officer community that could be potential challenges in adopting a new standard. These included maintaining tradition and unique department identities, and projecting an image of authority. They noted that attitudes in the LE community are shifting towards more functional designs for duty uniforms.

On the questionnaire, participants responded that a new duty uniform design should incorporate some level of CB protection. They also identified protection against ballistics, blood, fluid, and pathogens as significant needs. They noted good durability, functionality, and comfort among several other factors a new duty uniform should have, and all responded that a duty uniform standard is needed.

Half of the group said that the source of funding would affect their purchase of a uniform. Most said that they replace their duty uniforms fewer than once a year, and that their uniforms are paid for by departmental funding. Abrasion and fading were identified as the most common durability problems. On average, durability of their duty uniforms was rated as being “Slightly” to “Moderately Good.”

This document reports research undertaken at the U.S. Army Natick Soldier Research, Development and Engineering Center, Natick, MA., and has been assigned No. Natick/TR-07/021 in a series of reports approved for publication.

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## Appendix A - Descriptions of Mission Roles

### *First Responder/Reporter:*

This is typically the first LE officer at the scene who discovers the actual incident and/or reports back to command with details. The first responder/reporter is most likely to happen upon the incident inadvertently and either discover contaminated citizens or be contaminated themselves. Limited training and overall awareness are contributing factors. The most important action that the first responder/reporter can take is to protect his/her respiratory functions, retreat from the situation, and report back to command. Protection requirements could be limited to respiratory protection, such as an escape mask or air-purifying respirator (APR), for safe evacuation. Once the first responder/reporter calls in the incident, the officer is expected to retreat and await backup. Backup personnel who respond will fall under one of the remaining four mission roles.

### *Perimeter Control:*

The perimeter control LE officer is responsible for ensuring that the overall situation is contained to eliminate the accidental exposure of persons in the vicinity. Order around the hot zone involves establishing a perimeter at the cold/warm zone line and then shifting the focus toward containing the situation. Containment could include, but is not limited to, the following tasks:

- Crowd disturbance and riot control
- Self defense and suspect control
- Vicinity patrol and security (e.g., regulating entry into and egress out of the hot zone)
- Lethal and non-lethal weapons handling
- Planning and communications
- Traffic direction
- Assisting other emergency responders
- Vehicle operation
- Physical mobility to contain a shifting threat

While engaged in these activities, perimeter control personnel could be exposed to off-gassing, liquid transference from other individuals, blood borne pathogens, and the like. Protection requirements for this mission role can include such equipment as an air purifying respirator (APR), a CB garment, gloves and footwear. The CB-protective ensemble must enable perimeter control personnel to complete their tasks safely and effectively by providing an ensemble that also resists cut and puncture, maximizes the range of motion and field of view, and provides dexterity and tactility.

### *Tactical Operations:*

During a CB incident, tactical units are called upon when needed to neutralize a situation within the warm or hot zones. A situation could involve alleviating a threat, apprehending a suspect, rescuing a hostage or locating a potential secondary device. Tasks associated with such tactical operations include, but are not limited to, the following:

- Dynamic entry
- Clearings and evacuations
- Confined space operations (e.g., close quarters battle)
- Self defense and suspect control
- Rescue missions
- Vehicle assault
- Planning and communications
- Vicinity patrol and security
- Weapons handling
- Night and low light engagements

Tactical units are required to enter the contaminated area and perform all functions that a tactical team without a full CB-ensemble would carry out. As such, this mission role requires high levels of personnel and equipment protection (e.g., ballistic protection for self-contained breathing apparatus (SCBA) compressed air tanks), while satisfying high mobility, agility, and tactility needs. Covertiness of the CB ensemble materials (e.g., color, noise) and equipment utilized (e.g., audible warnings) is also a concern.

### *Criminal Investigation:*

Once the vicinity has been secured but prior to HAZMAT clean-up, a crime scene investigation may ensue to probe the scene and collect evidence. Tasks associated with criminal investigation include, but are not limited to, the following:

- Evidence collection
- Sampling and monitoring
- Fine motor skills work (e.g., writing, fingerprinting, photographing, operating sampling equipment)
- Confined space activities
- Kneeling, crawling, bending, and lifting

The tasks associated with this mission role require high levels of personnel and equipment protection (e.g., puncture propagation tear resistance, burst strength) in conjunction with medium mobility and fine motor control. To complete their tasks safely and effectively, criminal investigators will require full body coverage in the form of a CB ensemble, SCBA, gloves (potentially multi-layered) and footwear.

### *HAZMAT:*

HAZMAT teams are primarily responsible for clean-up and decontamination of the hot zone, but they also administer first aid. Tasks associated with this mission role require high levels of exposure protection in conjunction with potentially fine motor control. HAZMAT personnel require similar protection to that outlined in the NFPA standards, namely protection against high concentrations of vapor and liquid. Equipment requirements include a CB garment with protective hood and integrated visor, SCBA, gloves and footwear. Because the HAZMAT mission role for LE is very similar to fire fighter HAZMAT operations, the LE HAZMAT requirements and protection levels should align with those outlined in the NFPA standards.

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## Appendix B - Ergonomic Scenario Descriptions

The following tasks/scenarios are proposed as evaluation items, to be used as timed tasks for gauging performance of the CB protective suits. The following assumptions underlie the tasks:

- Equipment mentioned is carried/can be carried within the suits by the LE personnel who would execute the tasks. Items should be logical and expected to be used for the particular task.
- Task order may need to be adjusted based on where and when the evaluation would take place (e.g., which building, outdoors/indoors, etc.), or to improve the scenario's flow.
- Distances can be lengthened or shortened as needed.
- The equipment is available during the evaluation.
- Before any tasks are finalized, a dry run is needed to ensure that tasks can be completed in a reasonable amount of time, without causing undue stress on the subjects wearing CB ensembles and masks.

All of these tasks were chosen with the intention that they can be easily learned by non-law enforcement test participants.

### *Mission: Perimeter Control*

- Items carried/worn: roll of caution tape, radio (with speaker-microphone), first aid kit (or placed nearby), small notebook, pen or pencil, flashlight, weapon and holster (9mm or other handgun assumed).
- Tasks
  1. From starting mark, run 50 feet to area to be controlled.
  2. Secure caution tape around one item (doorknob, stake, etc) and roll out at least 10 ft of tape before securing the other end. Tape should be approx 4 ft off the ground.
  3. Run back 50 feet to starting mark.
  4. Use radio to call command post. Write down instructions received via radio from command post.
  5. Retrieve notebook and pen. Draw rough sketch/map of scene.
  6. Walk back to caution tape, stepping over a guardrail on the way.
  7. Duck under caution tape and walk 20 ft beyond tape to 'victim' (dummy). Grab dummy under the arms and remove from cordoned-off area.
  8. Once in safe area, render first aid to victim by wrapping upper arm with bandage.
  9. Stand up and repair any damage to caution tape caused from dragging dummy to safe area outside perimeter.
  10. Walk back (50 ft) to starting area.
  11. Take out flashlight, turn it on, and pan across area beyond caution tape. Stow flashlight.
  12. Draw weapon from holster, hold upward "at attention" with two hands for 10 seconds, then re-holster weapon securely.

13. Run approximately 10 ft to other end of caution tape.
14. Re-draw weapon, aim, speak appropriate commands, and simulate firing two shots. Remove magazine from weapon, stow it, remove new magazine from belt and insert new magazine into weapon. Re-holster weapon.

*Mission: Tactical Operations*

- Items carried/worn: appropriate weapon, mock “flash-bang” grenade, handcuffs, grappling-type hook with approximately 25 feet of strong rope attached to the hook (optional), ram (optional).
- Tasks:
  1. Walk sideways along wall for 20 feet, stopping at closed door that opens in (away from approaching individuals).
  2. At this point, one of two options can be used (options allow actual removal/damage to the door if allowed during testing):
    - a. Open door from position aside door (using door handle/knob).
    - b. Force open door with ram carried to door by subject.
  3. Toss a “flash bang” grenade into doorway from position aside door.
  4. Wait 10 seconds, then enter doorway with weapon drawn and ready, dropping immediately to a squatting position. Mock aim and fire the weapon.
  5. Enter area beyond doorway.
  6. Speak appropriate verbal commands to dummy lying on floor 10 feet inside door, while keeping weapon trained on dummy.
  7. Approach dummy.
  8. Kneel next to dummy. Holster weapon. Use handcuffs to restrain the dummy’s arms behind its back.
  9. Drag dummy out the door by grasping it under the arms.

*Mission: Criminal Investigation*

- Items carried/worn: paper bag, tweezers, digital camera, fingerprint kit (brush, powder, tape)
- Tasks:
  1. Walk 25 ft to crime scene. On the way, subject will step over/around several “X” marks on the floor placed 2 ft apart and on different sides of the pathway. In addition, a narrow hallway will be used as part or all of the 25 ft available; If not available a pathway will be marked on the floor and the subject must walk within the lines.
  2. Approach a table with a 2-inch square marked off at the far side of the table.
  3. Bend forward as needed to use fingerprint kit to powder, dust and tape the print, and then remove the tape and secure the print on the tape.

4. Move 4 ft to the side, and locate small item (e.g., pin from O'Conner test) on floor. Squat and pick up item with tweezers. Place item in paper bag. Secure paper bag.
5. Stand up, move 6 ft further to same side. Squat down, retrieve digital camera and take photo of "object" on floor.
6. Stand, secure all items collected or used as necessary, move 6 ft backwards, then turn around and walk back to starting point.

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## Appendix C – Integration Issues Survey Results

The following tables show in verbatim the actual prioritized integration issues written by each participant on the integration survey. They are ordered by category, and the ranks shown represent the issue's ranking determined by that participant.

rank	<b>Physical Sustainability of Wearer</b>
1	sustainability - heat stress
1	sustainability
1	most frequent activities cause heat stress
2	heat stress
2	heat stress
2	heat exhaustion
3	sustainability of wearer
4	heat stress
5	heat stress
5	sustainability
5	heat stress
5	inability to hydrate through mask while in cb environment

rank	<b>Communications Issues</b>
1	communications difficult in CB
1	communications not well integrated into CB
2	communications radio/voice
2	hearing acuity
3	communication
3	communication voice/radio
4	communication – verbal/radio
4	integration of communications into PAPR/SCBA

rank	<b>Lack of National Standard</b>
1	non existing set of requirements for PPE characteristics
1	lack of national standards for LE
3	no nationwide standard hinders integration
4	refocus design for LE equipment from fire to cops.
4	inconsistent mission training across agencies
5	terminology / language differences across agencies

rank	<b>Interagency / Interdepartmental Incompatibilities</b>
1	interagency incompatibility of equipment
1	interoperability between all brands of equipment
2	interagency incompatibility of comms
3	interoperability between brands of equipment
4	interagency incompatibility of equipment

rank	<b>Dexterity Issues</b>
1	dexterity
1	functionality inhibited
3	manual dexterity

rank	<b>Difficulty Donning / Doffing</b>
2	donning
3	difficult donning / doffing
3	self donning
5	difficult donning / doffing

rank	<b>Poor Visual Acuity</b>
1	most frequent activities impair vision,
2	visual acuity
5	visual acuity.

rank	<b>Durability Issues</b>
2	durability of suit / protection
4	wear & tear resistance
4	durability (extreme temp) (ok to be idle for long time, ready to go when needed)

rank	<b>Respirator Interchangeability Issues (SCBA/PAPR)</b>
1	SCBA/PAPR interchangeability
4	SCBA/PAPR interchangeability

rank	<b>Equipment Integration Problems in CB Ensemble</b>
2	weapons/equipment in CPC/PAPR/SCBA
4	incompatibility with current equipment (helmet, boots, armor)

rank	<b>Inability to Characterize Threat / Validate Protection</b>
2	ability to characterize CB threat (concentration), and be aware of duration of protection
4	ability to verify and validate requirements based characteristics

rank	<b>Mobility Issues</b>
3	mobility issues
5	ergonomic issues. Flexibility
5	fit – too bulky. Poor mobility

rank	<b>Accessibility of Equipment</b>
2	access to equipment

rank	<b>Inadequate Equipment Testing</b>
3	need effective testing to test protection of all gear, interfaces, closures in live environment
5	review of existing testing results on CB protection from military

rank	<b>PPE Not Optimized For Daily Use</b>
2	PPE needs to be optimized for regular, day to day operations

rank	<b>Difficulties with Decontamination</b>
3	decontamination of weapons / electronics

rank	<b>Equipment Weight</b>
3	weight of equipment

rank	<b>Weapon Sighting / Facemask Integration</b>
4	mask / sight picture
5	face piece to sight picture issue

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## Appendix D – Duty Uniform Protective Needs Survey Results

The following tables show the actual prioritized protection needs written by each participant on the duty uniform needs survey. These needs are ordered by category, and the ranks shown represent the need's ranking determined by that participant.

rank	<b>Ballistic Protection</b>
1	Ballistic Protection
1	Bullet resistance / cut / puncture resistance
1	Ballistic Protection
1	Ballistic and puncture protection
2	Ballistic protection
3	ballistic

rank	<b>CB Protection</b>
	Semi-permeable garment, w/ sheeting properties, which would allow officers to escape from a recognized chem environment. Integrated ability to seal neck, arm, leg openings
1	
2	petroleum based chemicals
3	Blood borne pathogen / Chem bio resistance
3	acid based chemicals
3	Chem Bio Protection
4	some protection from various chemical hazards
4	chem bio protection
4	airborne irritants from chemical spills or explosions
5	cb protection
5	powder (anthrax style) – high risk agents

rank	<b>Blood, Fluid, Pathogens</b>
1	Bodily fluid protection / pathogens / spitting, urine, blood
2	Blood, sweat, suspect body fluids
2	Protection from blood borne pathogens
3	Blood borne pathogen / Chem bio resistance
3	CB – BSI (Body Substance Isolation)

rank	<b>Durability</b>
2	Protection from Abrasion, cuts, tears
2	Durability / Abrasion / Cut Resistance
3	durability
3	durability
4	durability
4	Laundering Capable Longevity

rank	<b>Cut/Puncture Protection</b>
1	Bullet resistance / cut / puncture resistance
2	Cut / Stab / Puncture Resistance
2	Durability / Abrasion / Cut Resistance

Rank	<b>Functionality</b>
1	Utility / range of motion / functionality
1	Functionality to assignment / mission
3	Equipment distribution / load bearing displacement

rank	<b>Comfort / Fit</b>
2	comfort
4	fit, comfort, no sharp pinch points
5	Comfort and ease of care so that officers will wear it
5	comfortable / professional appearance

rank	<b>Environmental Protection</b>
1	Protection from the elements
4	Thermal protection / reduction of heat stress / solar protection / ease for cooling of core temp
5	waterproof

rank	<b>Thermal Comfort</b>
3	heat / comfort / moisture wicking
4	breathability
4	Thermal protection / reduction of heat stress / solar protection / ease for cooling of core temp
5	cool to wear / little thermal build up

rank	<b>Appearance</b>
2	uniformity
5	comfortable / professional appearance
5	appearance
5	Color Choices

rank	<b>Flame / Flash Protection</b>
2	flash protection
3	flame retardant

rank	<b>Personal Location</b>
4	Personal Locators

## Appendix E - Participant Information Survey Results

The following tables summarize the responses on the participant background questionnaire. The term “frequency” refers to the number of times a particular answer was given. Percents are shown. In cases where participants did not answer a question, percentages are based only on the number of participants who provided a response. For those cases when a participant’s desired response was not available to choose from, they were encouraged to provide their response in a write-in area for that question. These responses are listed verbatim in supplemental tables for each question, if necessary.

Of the eleven members of the focus group one member was female and the rest were male. Slightly more than half the group was from local law enforcement, with four representing state agencies and one from a federal agency. Years of experience varied, but more than half the group said they have more than fifteen years of experience in law enforcement. Two members had between one and five years.

### 1. What is your gender?

**Gender**

	Frequency	Percent
female	1	9.1
male	10	90.9
Total	11	100.0

### 2. What type of agency do you work for?

**Agency Type**

	Frequency	Percent
federal	1	9.1
local	6	54.5
state	4	36.4
Total	11	100.0

3. *How many years of law enforcement experience do you have?*

**Years of Experience**

	Frequency	Percent
1-5 Years	2	18.2
6-10 Years	2	18.2
11-15 Years	1	9.1
>15 Years	6	54.5
Total	11	100.0

The group represented a variety of job functions, which were somewhat equally split between day-to-day operations, office work, or tactical/specialized duties. Some additional duties added by participants included a mix of these, and also training and lab duties among others.

4. *What is your primary job function?*

**Job Function**

	Frequency	Percent
Day to day field operations	2	18.2
Office / Headquarters	2	18.2
Tactical / Specialized	3	27.3
Other	4	36.4
Total	11	100.0

**Job Function (cont.) - others listed**

crime lab
exec officer
field ops
hazmat
instructor
investigations, some tactical
lab
tactical, training, field



Participants were asked to indicate if each of the five mission roles accurately describes how law enforcement would respond to a WMD (Weapon of Mass Destruction) incident. Almost all or all participants indicated that every mission role, with the exception of HAZMAT accurately describes law enforcement's role. During the focus groups some participants said that their departments typically do not handle any HAZMAT activities.

5. Which of the following mission profiles describe how law enforcement would respond to a WMD incident?

**CB Misison Profiles**

	Freq.
First Responder / Reporter	10
Perimeter Control	11
Tactical Operations	11
Criminal Investigation	10
HAZMAT	5

The next question asked participants to indicate the minimum number of hours that they would need to be protected in a CB environment, based on the mission roles of perimeter control, tactical operations, and criminal investigation. From the focus group discussions participants agreed that for perimeter control and criminal investigation the time should be at least one shift, or around 8-10 hours. Here most respond similarly, with the majority indicating 6-12 hours and some indicating longer for those roles. For Tactical Operations most participants chose 1-6 hours which is consistent with their discussions, in which many felt that these operations are conducted as fast as possible.

6. What is the minimum number of hours that your CB system would typically need to provide protection in the following mission profiles?

**Minimum Hours - Perimeter Control**

	Frequency	Percent
6-12 hours	9	81.8
>12 hours	2	18.2
Total	11	100.0

**Minimum Hours - Tactical Operations**

	Frequency	Percent
<1 hour	1	9.1
1-6 hours	8	72.7
6-12 hours	2	18.2
Total	11	100.0

**Minimum Hours - Criminal Investigation**

	Frequency	Percent
6-12 hours	9	81.8
>12 hours	2	18.2
Total	11	100.0

When asked how often they respond to potential CBRNE incidents, answers were varied, but the greatest percentage of participants said typically less than once a year. At least one participant said they respond once or more a month. Some also included frequent training.

**7. How often do you respond to a potential CB incident?****How often do you respond to a potential CBRNE incident?**

	Frequency	Percent
Once a month	1	9.1
Approximately 4 times a year	3	27.3
Less than once a year	5	45.5
other	2	18.2
Total	11	100.0

**How often do you respond (cont.) - others listed**

>25 per year. Clandestine meth labs
Bomb threats-not CB
Train monthly
Train responders

Participants described the CB garments that they typically wear. Many included more than one type of garment.

8. Please provide product information on the CB garment/suit you typically utilize?

**CB Garments used by participants**

	Freq.
Dupont CPF3	3
Kappler CPF	1
Lion Apparel MT94	2
Saratoga	1
Trellchem VPS (level A)	1
Tychem F	2
Tychem SL	4
Tyvek F	5

Most participants said that they wear their undershirt and shorts under their CB ensemble while a few did not, and slightly more than half the group said they wear a duty uniform under their CB gear. For the duty belt, eight of the members said that they wear it over their CB ensemble. No one said that they wear it underneath. Responses were similar for weapon and holster, with one participant saying that they carry it under CB gear. Body armor, the responses showed, is more typically worn under CB gear than over it.

9. What components are typically worn UNDER your CB ensemble?

**What components are typically worn UNDER your CB ensemble?**

	Included	
	#	Percent
Under CB - Undershirt/shorts	8	72.7%
Under CB - Duty uniform	6	54.5%
Under CB - Duty belt and components	0	.0%
Under CB - Weapon and holster	1	9.1%
Under CB - Body armor	6	54.5%
Under CB - other	4	36.4%

**Components worn UNDER CB (cont.) - others listed**

Camelback
Crime scene processing
PT Gear
Uniform pants

10. What components are typically worn OVER your CB ensemble?

**What components are typically worn OVER your CB ensemble?**

	Freq.	Percent
Over CB - Duty belt and components	8	72.7%
Over CB - Weapon and holster	7	63.6%
Over CB - Body armor	2	18.2%

**Components worn OVER CB (cont.) - others listed**

Load bearing vest
radio, SCBA in Level B&C
SCBA-helmet
SCBA
SCBA/Rebreather/PAPR
APR, reflective vest (traffic)
Helmet
SCBA HyRID Respirator

When asked if they typically have compatibility problems involving their CB equipment, approximately three quarters of the group said that they experience them.

11. Do you typically experience any problems with components of your CB PPE being incompatible with each other?

**Do you experience CB PPE compatibility problems?**

		Frequency	Percent
Valid	Yes	8	72.7
	No	3	27.3
	Total	11	100.0

Participants indicated how often they experience durability problems with their CB garments. Eight or nine participants have experienced problems with tearing, abrasion, seam separation, fading, and fabric piling. Just over half of the group said they have experienced staining. Of those who have had problems, tearing and abrasion are the more common issues, although mean scores indicate that in general, problems occur “rarely” to “sometimes.” The table below displays the frequency of each response by problem, along with the mean response for those who gave an answer greater than “never.” Overall, participants rated durability of their current garments “slightly good”

based on a mean score of 6, using a 9-point hedonic scale ranging from 1 to 9 (“Extremely Bad” to “Extremely Good”).

12. Please indicate how often each of the following durability problems occur to your current CB garment, if at all?

**CB PPE**

Frequency of Durability Problems	Never	Rarely	Sometimes	Often	Mean <sup>1</sup>
Tearing	2	3	5	1	1.78
Abrasion	2	4	5	0	1.56
Seam Separation	3	6	1	1	1.38
Fading	3	6	1	0	1.14
Staining	5	5	1	0	1.17
Fabric Piling	3	7	1	0	1.13

<sup>1</sup> Mean values based on possible scale of 1-5. (1="Rarely" to 5="Always")

Mean values shown represent only those participants who said they have experienced problems.

13. How would you rate the overall durability of your current CB garment?

Overall Durability of CB Garment	Mean <sup>1</sup>	N
Overall Durability	6.00	11

<sup>1</sup> Mean values based on possible scale of 1-9. (1="Extremely Bad" to 9="Extremely Good")

Almost all the participants answered that there is a need for improved duty uniforms. Many mentioned the need for some level of CB protection. They also mentioned improved characteristics, including comfort and load bearing. One participant believed that there is no need for new duty uniforms.

14. Do you feel there is a need for improved duty uniforms?

**Is there a need for improved duty uniforms?**

	Frequency	Percent
Yes	10	90.9
No	1	9.1
Total	11	100.0

**Need exists for an improved duty uniform - Additional Comments**

CB protection with modification  
 Current uniform offers no protection and not conducive to application of CB PPE  
 Duty uniforms should include chemical protective characteristics  
 Duty uniforms should add protection in CB environment  
 Duty uniforms that followed a standard for fire, static, etc  
 From discussion today, a duty uniform with any level of CB protection would be helpful.  
 Adequate protection for first responders.  
 More ergonomic. Greater options for equipment visibility and load bearing.  
 No fire protection - is better if uniform is removed before donning PPE  
 Quieter, lighter-breathable

**Need does not exist for an improved duty uniform - Additional Comments**

Current NBC ensembles cover all possibilities

The following tables show which types of duty uniforms are owned by participants. Between seven and eight participants have the Class A, Class B, and BDU uniforms. They also added Nomex flight coveralls and others.

15. What type of duty uniforms do you currently have?

**Current Duty Uniforms**

	Freq.	Percent
Current duty uniforms - Class A	8	72.7%
Current duty uniforms - Class B Tactical Uniforms	7	63.6%
Current duty uniforms - BDUs	8	72.7%
Current duty uniforms - other	6	54.5%
Current duty uniforms - other	1	9.1%

**Current duty uniforms (cont.) - others listed**

Class C; specifically for riots  
 Jacket  
 Nomex flight coveralls  
 Nomex flight suits  
 Polo shirts, shorts (bike patrol)  
 Regular garments

Participants provided the brand and type of each of their duty uniform garments. Several types of Class A and Class B uniforms were described, as were a few others. Brands included Fechheimer™, Flying Cross™, Horace Small™ and others.

16. Please provide product information on the duty uniforms you typically wear. List any shirts (short and long sleeve), trousers, and/or shorts (if applicable).

Type	Garment	Brand	Freq.
CLASS A	Shirt	Bauer	1
CLASS A	Shirt	Elbeco	1
CLASS A	Shirt	Fechheimer	3
CLASS A	Shirt	Flying Cross	3
CLASS A	Shirt	Horace Small	3
CLASS A	Shirt	Safari	1
CLASS A	Trousers	Bauer	1
CLASS A	Trousers	Fechheimer	3
CLASS A	Trousers	Flying Cross	1
CLASS A	Trousers	Flying Cross	1
CLASS A	Trousers	Horace Small	3
CLASS B	Shirt	511	3
CLASS B	Shirt	Fechheimer	1
CLASS B	Shirt	Horace Small	1
CLASS B	Shirt	various	1
CLASS B	Trousers	511	3
CLASS B	Trousers	Fechheimer	1
CLASS B	Trousers	Horace Small	1
CLASS B	Trousers	various	1
CLASS C	Shirt	Fechheimer	1
CLASS C	Trousers	Fechheimer	1
CLASS D	Coverall	US Gov't	1
Tactical	Shirt	Topps	1
Tactical	Trousers	Topps	1
BDU	Shirt		1
BDU	Trousers		1

Most participants said that funding for their duty uniforms comes from department funds. A few said that they use federal, state or personal funds.

17. What type of funding source is used to purchase your duty uniform(s)?

**Funding Source**

	Freq.	Percent
Duty uniform funding - Departmental funds	9	81.8%
Duty uniform funding - Federal grants	2	18.2%
Duty uniform funding - State grants	1	9.1%
Duty uniform funding - DHS funding	0	.0%
Duty uniform funding - Personal funds	2	18.2%
Duty uniform funding - other	1	9.1%

**Funding source for duty uniform (cont.) - others listed**

USMC
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The group was split between those who said that the type of funding source affects the uniform(s) they purchase, and those for whom the type of funding does not.

18. Does the type of funding source affect which type of duty uniform you purchase? If yes, would you have chosen a different uniform? Please describe which kind.

**Uniform purchased affected by funding source?**

	Frequency	Percent
Yes	5	45.5
No	6	54.5
Total	11	100.0

**Does funding source affect type of duty uniform purchased?**

Is grant funded - purchase dictate by grant requirements.
Yes possibly. PPE for First responders were selected from available funds.
Yes, Saratoga



Slightly two thirds of the group responded that the cost of their duty uniform is between \$100 and \$150 dollars. Most said that they do not have to replace their uniform every year, but two said that they need to replace them about four times per year.

19. *What is the approximate cost of your current duty uniform (shirt and trousers)?*

**Approximate cost of current duty uniform**

	Frequency	Percent
\$50 - \$100	3	27.3
\$100 - \$150	7	63.6
Total	10	90.9
Missing System	1	9.1
Total	11	100.0

20. *How often do you have to replace your current duty uniform?*

**How often replace current duty uniform?**

	Frequency	Percent
Approximately 4 times a year	2	18.2
Less than once a year	9	81.8
Total	11	100.0

Participants indicated how often they experience durability problems with their current duty uniforms. All participants indicated that the problems listed occur at least some of the time. The most frequent problems appear to be abrasion and fading based on the mean results which fell in the range of “sometimes” to “often”. At least one participant answered that fading and fabric piling occur “always.” The table below displays the frequency of each response by problem, along with the mean results. Overall, participants rated overall durability of their current duty uniforms as 6.27, which is in the range of “slightly good” to “moderately good” on a 9-point hedonic scale ranging from 1 to 9 (“Extremely Bad” to “Extremely Good”).

21. Please indicate how often each of the following durability problems occurs to your current duty uniform, if at all.

Duty Uniform						
Frequency of Durability Problems	Never	Rarely	Sometimes	Often	Always	Mean <sup>1</sup>
Tearing	0	6	4	1	0	1.55
Abrasion	0	3	5	3	0	2.00
Seam Separation	0	6	4	1	0	1.55
Fading	0	2	6	2	1	2.18
Staining	0	4	7	0	0	1.64
Fabric Piling	0	9	1	0	1	1.36

<sup>1</sup> Mean values based on possible scale of 1-5. (1="Rarely" to 5="Always")

Mean values shown represent only those participants who said they have experienced problems.

22. How would you rate the overall durability of your current duty uniform?

Overall Durability of Duty Uniform	Mean <sup>1</sup>	N
Overall Durability	6.27	11

<sup>1</sup> Mean values based on possible scale of 1-9. (1="Extremely Bad" to 9="Extremely Good")

Next, participants were asked if they wear ballistic and impact protective helmets as part of their jobs. Additional questions followed for those who answered yes to either, although a few participants answered those questions regardless. Almost half of the group said they wear a ballistic helmet, while three out of eleven wear impact head protection.

23. Do you typically wear a ballistic helmet as part of your job?

Ballistic Helmet typically worn in job		
	Frequency	Percent
Yes	5	45.5
No	6	54.5
Total	11	100.0

24. Do you typically wear an impact protective helmet as part of your job?

**Impact Protective Helmet typically worn in job**

	Frequency	Percent
Yes	3	27.3
No	8	72.7
Total	11	100.0

Only one participant wears head protection daily, while the rest answered that they wear it either occasionally or in extreme circumstances.

25. How often do you wear your helmet?

**How often do you wear your helmet**

	Frequency	Valid Percent
All Day Everyday	1	11.1
Occasionally	4	44.4
Extreme Circumstances Only	3	33.3
Never	1	11.1
Total	9	100.0
Missing System	2	
Total	11	

Five of the participants reported their helmet's ballistic protection level, while two others did not know it. Three members said they have Level IIA protection.

26. Which ballistic protection level is your helmet rated for?

**Ballistic Protection Level Rating**

	Frequency	Valid Percent
Level II	1	12.5
Level IIA	3	37.5
Level IIIA	1	12.5
I Don't Know	2	25.0
Other	1	12.5
Total	8	100.0
Missing System	3	
Total	11	

Ballistic Protection Level Rating (cont.) - others listed

USMC Kevlar (low velocity fragments)

When asked what type of weapon threat they are most concerned about, four participants answered “handguns,” three answered “shrapnel or fragmentation,” and two answered “rifles.” For impact threats, two participants were concerned with “sharp weapons,” while six responded “other.” Weapon threats and accident protection was mentioned.

27. *What type of weapon/projectile are you most concerned about?*

**What weapon/projectile are you most concerned about?**

	Frequency	Valid Percent
Handguns	4	44.4
Rifles	2	22.2
Shrapnel/Fragmentation	3	33.3
Total	9	100.0
Missing System	2	
Total	11	

28. *What type of impact threat do you require protection against?*

**What type of impact threat do you require protection against?**

	Frequency	Valid Percent
Valid Sharp Objects / Weapons	2	25.0
Other	6	75.0
Total	8	100.0
Missing System	3	
Total	11	

**Impact Protection Threats (cont.) - others listed**

Bullets, projectiles
Firearms, falling - hitting head

Participants were asked to rank three reasons for wearing a helmet in order of importance, from “1<sup>st</sup>” to “3<sup>rd</sup>,” with “1<sup>st</sup>” having the greatest importance, “2<sup>nd</sup>” having the second greatest importance, and so on. A weighted sum score is shown in the table below, which applies different weights to the three ranks to give an overall score representative of the participants’ opinions. Ballistic protection was shown to have the greatest importance, followed by impact protection, and then environmental protection, which was selected third by all participants. A few participants selected the same ranking for more than one reason.

29. Rank the reasons for wearing a helmet from 1 to 3 (or 4) in order of importance, with 1 being the MOST important.

Reasons for wearing helmet	Ranks in order of importance			Weighted
	1st	2nd	3rd	Sum <sup>1</sup>
Ballistic Protection	7	2	0	25
Impact Protection	2	6	0	18
Environmental Protection	0	0	7	7

<sup>1</sup> Weighted sum determined by applying weight to each rank and computing the sum.

Weights: 1st=3pts, 2nd=2pts, 3rd=1pts. Greater weighted sum indicates higher group ranking.

Participants said that they wear helmets on large vessels, with just under half of the group wearing helmets in rotary wing aircraft and on foot. About a third of the group answered “yes” for riding in a vehicle or motorcycle. About three or fewer answered “yes” to the remaining situations. One included civil disturbances as an additional situation.

30. What is the primary situation in which you are likely to be wearing a helmet?

**Situations in which you wear a helmet**

	Freq.	Percent
Large Vessel or Boat	11	100.0%
Small / Fast Vessel or Boat	3	27.3%
Fixed Wing Aircraft	1	9.1%
Rotary Wing Aircraft	5	45.5%
Car / Truck	4	36.4%
Motorcycle	4	36.4%
Bicycle	0	.0%
On Foot	5	45.5%
Other	1	9.1%

**Situations when you wear a helmet (cont.) - others**

Civil disturbance
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Regarding headgear accessories, items selected most by participants were gas/CB protection and eye protection. More than half the group also indicated night vision, communications accessories, and hearing protection.

31. Do you currently have or use any of the following accessories with your protective headgear?

**Which of these headgear accessories do you have or use?**

	Freq.	Percent
Camera	2	18.2%
Illuminator (flashlight)	4	36.4%
Infra-red illuminator	2	18.2%
Night vision equipment	7	63.6%
Communications	6	54.5%
Eye Protection	8	72.7%
Hearing protection	6	54.5%
Gas / CB protective mask	9	81.8%
None	1	9.1%
Other	2	18.2%

**Headgear Accessories (cont.) - others listed**

SCBA
SCBA/Rebreather/PAPR

About two thirds of those who responded said that they have experienced compatibility problems with their headgear accessories. When asked which accessories were incompatible, participants mentioned communications, respirator equipment, and night vision gear among others.

32. Do you experience any problems with headgear accessories being incompatible with each other or your helmet?

**Do you experience compatibility problems between headgear accessories or your helmet?**

	Frequency	Valid Percent
Yes	6	66.7
No	3	33.3
Total	9	100.0
Missing		
System	2	
Total	11	

**Headgear Accessories Incompatibilities (cont.) - others listed**

All - Coms, APR
Most headphones for communications
Night vision incompatible with APR.
Respirator, communications, eye protection, night vision
SCBA



